a considerable augmentation of the temperature of the air surrounding the bulb of the thermometer takes place unless the enclosure, by means of a circulating external cold medium, is maintained at a constant temperature.

Mr. Williams' assumption that the intensity of a gas flame is proportional to the quantity of gas consumed, requires some consideration. Persons practically acquainted with the subject of combustion are well aware of the fact that the intensity of a flame depends on its form and the manner of applying the oxygen, the quantity of combustibles consumed being a subordinate element in the determination of intensity. The annexed table exhibits the result of an experiment just concluded, instituted to determine accurately how far the radiant intensity transmitted by a single gas flame depends on the quantity of gas consumed :—

Consumption of gas per hour.	Temperature of medium surrounding the thermometer.	Temperature indicated by thermometer.	Radiant intensity transmitted by the flame.
Cubic feet.	Deg. Fah.	Deg. Fah.	Deg. Fah.
1·0	60·0	60·63	0·63
1·5	60·0	60·90	0·90
2·0	60·0	61·12	1·12
2·5	60·0	61·30	1·30
3·0	60·0	61·47	1·47
3·5	60·0	61·61	1·61
4·0	60·0	61·74	1·74
4·5	60·0	61·84	1·84
5·0	60·0	61·93	1·93
5·5	60·0	62·01	2·01
6·0	60·0	62·08	2·08
6·5	60·0	62·14	2·14
7·0	60·0	62·19	2·19

It will be seen at a glance, on examining our table, that the radiant intensity transmitted to the thermometer (placed at a considerable distance from the flame, in order to reduce the subtended angle) is not proportional to the quantity of gas consumed. For instance, the differential temperature called forth by the consumption of 7·0 cubic feet of gas per hour is 2°·19, while a consumption of 3·5 cubic feet produces 1°·61, in place of the theoretical temperature $\frac{3{\cdot}5 \times 2{\cdot}19}{7{\cdot}0} = 1^\circ{\cdot}09$; thus showing a discrepancy of $1{\cdot}61 - 1{\cdot}09 = 0^\circ{\cdot}52$. Again, the consumption of 1·0 cubic feet per hour, instead of developing a temperature of $\frac{1 \times 2{\cdot}19}{7} = 0^\circ{\cdot}31$, we find that fully twice that degree of heat is imparted to the thermometer. The reason is obvious ; but it is not intended on this occasion to enter into a discussion of the cause of the stated discrepancy, the object being simply to show the irrelevancy of Mr. Williams' criticism concerning the absence of a record of the quantity of gas consumed.

J. ERICSSON

NOTES

WE are very glad to read the strong and earnest terms in which Mr. Gladstone on Saturday, at the distribution of prizes at the Liverpool College, spoke of the enormous waste of power shown in the administration of our English University endowments, the amount of which is probably equal to that of the whole of the endowments of continental universities taken together, whereas, perhaps, in no other country is there less absolute work to show. England contrasts most unfavourably in this matter with almost every other country in Europe, including her northern and certainly much poorer sister, Scotland. We hope the words of the Prime Minister are an earnest that he will do his best to put an end to this humiliating state of things.

IN the Washington daily *National Republican* newspaper of Dec. 4, a report of Prof. Tyndall's first lecture there is given. The contrast between the first and last paragraphs is very transatlantic.—"Every available inch of room in Lincoln Hall was occupied last evening by an audience distinguished for its appreciation of learning and its enthusiasm in the presence of a great teacher. Conspicuous in the vast assemblage were the faces of citizens eminent for their own advancement in science—citizens who have won imperishable laurels in scaling that mountain on whose jeweled and glittering apex the feet of Prof. Tyndall rest. They were there, the guests of a brother, at an intellectual feast so rich and rare that the profoundest learning, combined with the highest form of genius, was required to prepare and serve it. Prof. Henry, in a short introductory speech, presented Prof. Tyndall to the audience. The lecture throughout was of absorbing interest, and all the experiments and teachings were made so clear and simple that a child could understand them. However, if the old gentleman who was hugging and talking with a young girl all the time, will keep away from the next lecture, those who were annoyed by him will feel thankful." The Washington *Morning Chronicle* of Dec. 6 thus refers to the second lecture—"Another brilliant audience crowded Lincoln Hall to repletion last evening to listen to the distinguished English scientist. Conspicuous in it were President Grant and Miss Nellie, who evinced their interest by undivided attention to the lecturer and his brilliant experiments, Secretary Robeson, Postmaster-General Creswell, and many other of our chief dignitaries. Of course it is useless to protest against the dictates of fashion, but we would like to suggest to the ladies that if they must wear the two-story hats now in vogue, they leave out the tall feather for the benefit of those who have to sit behind them."

THE Council of the Zoological Society have conferred the silver medal of the Society on Mr. A. D. Bartlett, superintendent of the Society's gardens, "in recognition of his valuable services to the Society, and in commemoration of the birth and successful rearing of the young hippopotamus, born on Nov. 5;" and the bronze medal on Michael Prescot and Arthur Thompson, the two keepers who had had charge of the hippopotamus during the late eventful period.

THE Chancellor of the Exchequer has declined to accede to a representation from British horticulturists to increase the grant of 6,000*l.* in aid of the British contribution to the Vienna Exhibition of next year.

A SUM of 500*l.* having been placed at the disposal of the Council of the Society of Arts, for promoting, by means of prizes or otherwise, economy in the use of coal for domestic purposes, the Council have decided to offer prizes, including the Society's gold medal and 50*l.*, for each of the following objects :—1. For a new and improved system of grate, suitable to existing chimneys as generally constructed, which shall with the least amount of coal answer best for warming and ventilating a room. 2. For a new and improved system of grate suitable to existing chimneys as generally constructed, which shall with the least amount of coal best answer for cooking food, combined with warming and ventilating the room. 3. For the best new and improved system of apparatus which shall, by means of gas, most efficiently and economically warm and ventilate a room. 4. For the best new and improved system of apparatus which shall by means of gas, be best adapted for cooking, combined with warming and ventilating the room. 5. For any new and improved system or arrangements, not included in the foregoing, which shall efficiently and economically meet domestic requirements.

THE Council of the Society of Arts have resolved to offer the Society's gold medal to that manufacturer who shall produce and send to the London International Exhibition of 1873 the best specimens of steel, suitable for affording increased security in the construction of locomotive and marine engines and boilers, and for other engineering purposes.

MR. JAMES MCNAB, Curator of the Royal Botanic Garden, Edinburgh, was unanimously elected President of the Botanical Society at their last meeting, in room of Prof. Wyville Thomson. The Society was founded in 1836, and Mr. McNab is one of the original twenty-one members, only eight of whom are now alive.

AT the suggestion of Mr. Carruthers, the time ot competition for Lord Cathcart's prize for the best essay on the cause of and mode of preventing the potato disease, has been extended to November 1, to give candidates an opportunity for practical research on the subject.

MR. EMMANUEL DEUTSCH has obtained six months' leave of absence on account of his health. He intends to spend the time in Egypt.

WE hear that the proprietors of the *Daily Telegraph* have placed an unlimited sum at the disposal of the Society of Biblical Archæology, to enable Mr. Smith, the author of the paper on the Chaldee account of the Deluge, to proceed to the East for the purpose of further investigation among the Assyrian ruins.

WE understand that Mr. Cleminchaw and Mr. Jongstaff, who were placed in the first class in Natural Science at Oxford, and who are mentioned as having been educated at Rugby School, were students in Natural Science at King's College, London.

THE Berlin Geographical Society has opened subscriptions for the contemplated Congo Expedition. Dr. Gussfield, the glacier explorer, who is to be the leader of the enterprise, has himself contributed nearly 1,000*l.*, and there is every prospect that the full amount necessary will be forthcoming.

MR. EDWARD D. COPE, of the Academy of Sciences, Philadelphia, has just returned to that city from a geological expedition in the territories of Wyoming and Nevada, during which he has explored a large area of Eocene and Cretaceous strata, and made some fine discoveries. Remains of over fifty new Vertebrata have been obtained, amongst which is a new *Dinosaurian* allied to *Cetiosaurus.* Amongst the mammals are some new *Proboscideans,* which appear to have been furnished with horns, and to form a transition towards the *Perissodactyle Ungulates.*

MR. J. P. GASSIOT, F.R.S., has presented to the Royal Institution a marble bust of the late Mrs. Somerville by M'Donald, the sculptor, of Rome.

WE learn from the *British Medical Journal* that Dr. Apjohn of Dublin has been appointed to the Prælectorship of Chemistry in Caius College, Cambridge.

THE Birmingham and Midland Counties branch of the British Medical Association has decided to take steps to form a microscopical section.

THE Clifton College Scientific Society has just issued the third part of its "Transactions," wherein the officers speak favourably, and apparently not without warrant, of the present position of the Society. The list of members is always full and the attendance at the meetings most satisfactory. The amount of practical work done by the members is still a weak point, but signs of improvement are not wanting. Among the papers published in this volume the two which appear to show the largest amount of original observation are both geological—"Aust Cliff," and "The Oolite at Minchinhampton," both by H. Wills, and both illustrated by sections. The museum of the college has acquired many valuable additions during the past year, Altogether, we cannot doubt that the Society is doing a most useful work in fostering a taste for natural science.

THE last part of the Proceedings of the Bath Natural History and Antiquarian Field Club is more concerned with the latter than the former portion of their programme. There are, however, one or two short papers on subjects connected with Natural Science, and an interesting sketch of the biography of early geologists connected with the neighbourhood of Bath, by Mr. W. S. Mitchell. A summary of the Proceedings of the Club for the year 1871-72 is appended, together with the Address of the President, the Rev. Leonard Blomefield (late Jenyns) after the anniversary dinner.

WE have before us the eleventh Annual Report of the Lower Mosely Street (Manchester) Schools Natural History Society. The meetings of the society have been held weekly throughout the year. The number of communications to the Society during the year in the form of lectures and papers has been twenty-three, on a great variety of subjects in the various branches of natural science. All of them were well illustrated, some by means of the microscope, others by diagrams and objects combined. We cannot too highly commend the labours of a society doing its work in this quiet and unobtrusive way in the midst of one of our most crowded cities.

WE have received from the Hydrographer to the Admiralty a series of Physical Charts of the Pacific, Atlantic, and Indian Oceans.

THE scheme for establishing a Technical College in Glasgow is now assuming a somewhat tangible shape. A subscription list has just been issued, in which we find that thirty subscribers have among themselves contributed no less than 11,050*l.* Subscriptions of 1,000*l.* each have been given by the firm of Robert Napier and Sons, the eminent shipbuilders and engineers; Mr. W. Mongomerie Neilson, of the Hyde Park locomotive works, and son of the inventor of the hot-blast; and Mr. John Tennant, the head of one of the oldest and largest chemical firms in the world. Of the thirty subscribers, twenty-two are members of the general Committee. It is proposed, when 20,000*l.* is subscribed, to begin the actual organisation of the Technical College, establishing, in the first instance, chairs for—(1) naval architecture and marine mechanical engineering; (2) the theory and practice of weaving; and (3) the theory and practice of dyeing and printing on textile fabrics.

WE learn from the San Francisco *Morning Bulletin* that there is in course of construction at Woodward's Gardens a salt-water aquarium of modest dimensions, yet designed to be complete in all its parts. A year ago the proprietor of the Gardens sent Charles Schumann to Europe to examine the sea aquaria of Paris and other cities. After much time spent in investigation, Mr. Schumann determined to draw his plans on the model of the Berlin aquaria, though on a smaller scale. The building now in progress is the result. The aquarium will be mainly under the surface of the ground, in order to secure an even temperature. There are fifteen tanks in all, one of which is for freshwater specimens. The tanks vary in size from 300 to 1,000 gallons capacity, the largest containing eight thousand pounds of water. Several of the tanks are fitted up with sea-worn rocks obtained at the cliff-house, and some at Santa Cruz. There will be room for marine plants, shells, corals, &c. It is the intention to obtain deep-sea animals and other rare denizens of the deep, with a live shark or two, a devil fish, &c.

Dr. Nathaniel Haycroft has reprinted his inaugural address, delivered before the Leicester Literary and Philosophical Society, on the Limits of Scientific Inquiry; and we find also the abstract of a paper read at the last meeting of the Natural Science Section of the Sheffield Philosophical Society by the President, Dr. Hime, on Phenomena and Forces, both rather extensive subjects for an hour's discourse.

The following is from the *Journal of the Society of Telegraph Engineers*:—"Thanks to the noble exertions of the illustrious president of the Italian Geographical Society, the idea of an Arctic expedition under the Italian flag is gradually working its way into their minds. Funds have been offered, and the prospect is brightening that the old voyage of the *Zeni*, though the first, will not be the last of the Italian Arctic expeditions." The same journal says that Signor Guido Cora announces his intention of editing an Italian geographical periodical, to be entitled *Kosmos*, the first number of which is to appear on January 1, 1873.

The following is from the *School Board Chronicle*:—"New York has 101,883 scholars to rather over a million of inhabitants; these children receive their instruction from 2,765 masters (*i.e.*, one teacher to every thirty-six pupils); the educational budget amounts to very nearly 700,000*l*., or 7*l*. for each child. In England, in one year, 35,999 men and 49,522 women were found unable to sign the marriage register."

Numerous seals, very rare in these waters, are making their appearance at the mouth of Holy Loch and in Loch Long, in the Frith of Clyde.

We learn from the *American Agriculturalist* that it has been finally decided to locate the arboretum, for which a large bequest was made to the Harvard University by Mr. Arnold, of New Bedford, on a farm, about ten miles south of Boston, where the School of Agriculture already exists. The details of the work are to be under the immediate control of Prof. Sargent, who is eminently well qualified for it. He proposes to lay out the ground (137 acres of well-diversified land) as a natural park, with drives and walks tastefully arranged, and leading from one family to another, in scientific order, of all the trees and shrubs hardy in that climate.

A "Centennial Commission" has been appointed by the American Congress to mature a scheme for the celebration of the nation's hundredth anniversary in 1876, by holding an International Exposition in Philadelphia, which shall be "the grandest the world has ever seen." The sum required to conduct it properly is estimated at $10,000,000, and each State is called upon to subscribe its share of the amount as definitely fixed by the Commission. At a recent public meeting in Philadelphia $100,000 worth of stock was taken in fifteen minutes.

The American Palestine Exploration Society, of which we have already made mention in our columns, is about sending off an expedition for the purpose of carrying out the objects of that body. According to the *Independent*, it is to be under the direction of Lieut. E. Steever, U.S.A., who will have special charge of the topographical survey, and of the preparation of a reliable map. He will be accompanied by Prof. John A. Payne, late of Robert College, Constantinople, who will superintend the archæological department, and make what collections he can in natural history and geology; but, being himself especially a botanist, he will devote his principal attention to that branch. Mr. Van Dyke and other gentlemen will probably accompany the party to the field, and among them will be an artist of considerable reputation. This labour is one, of course, that will require some time for its completion; and, according to the *Independent*, at least six years will be necessary to accomplish its object thoroughly, even allowing for the assistance of a British society (organised for a similar purpose) in doing its share of the work.

THE DIOSMOTIC PROPERTIES OF COLLOIDS*

Dutrochet, in his researches on osmose, examined the properties of certain organic non-crystallisable substances (later named colloids by Graham).

Comparing the colloids gelatin, gum-arabic, and albumen (from hens' eggs) with cane sugar, he thus expressed numerically the endosmotic power of these substances:—Gelatin, 3; gum-arabic, 5·17; sugar, 11; albumen, 12. Thus the endosmotic force attributed to the colloids was considerable, in the case of albumen exceeding that of sugar.

These results must, however, be considered in great measure fallacious, as, while the specific gravities of the solutions were equal, (1·01) their degrees of concentration were very different. The solutions of gelatin and albumen contained 4·1 per cent. of these substances, while the sugar solution scarcely contained 2·5 per cent. of sugar. On this ground the sugar must be ranked above the colloids.

There is another circumstance to be considered. Dutrochet used the colloids in their natural state (common gum-arabic and albumen direct from the egg), and in this form they contain over 3 per cent. of mineral substances, chiefly salts of lime and potash. Since Graham pointed out the great difference between crystalloids and colloids, as regards diffusion in water and passage through a membrane, it was to be expected that the presence of crystalloids in the colloidal substance would considerably mask the diosmotic properties of the latter. In the writer's experiments he employed colloids freed from mineral substances, comparing their diosmotic properties with those of the same substances in the natural state. Contrary to the generally received opinion that these substances have a high endosmotic power, he found that this is not the case, though certain variations are met with, which will presently be explained.

Solutions of pure colloids showed, when of moderate concentration, a very weak endosmose. The properties of the membrane, however, distinctly affect the results. Animal bladder, parchment, and artificial cellulose, are very near one another in this respect. With the first two the concentration of an albumen or arabin solution might be raised to about 10 per cent. without any perceptible increase of volume in the solution, at the expense of the pure water. Tannin gave a slight endosmose; a 10 per cent. solution in 24 hours received 1·0 cc. water (the membrane being parchment). The degree of concentration now given may be considered about the limit within which, for these substances, and with the membranes named, no addition of water takes place. With the artificial cellulose, the limit seems to be somewhat lower, for a 9 per cent. arabin solution gave (with it) a perceptible, though very weak endosmose (about 0·45 c c) in 24 hours, and a tannin solution 7 per cent. increased in volume 0·8 cc. in the same time.

On comparing with colloids in the impure state, it was found that while a 10 per cent. arabin solution received hardly any water through the parchment, (about 0·5 cc.), an equally concentrated solution of common gum-arabic increased in volume, in the same circumstances, about 2·55 cc.

When a pyroxilin membrane was used with the pure colloids, the endosmotic action was considerably greater than that which took place in the other membranes. Thus with pyroxilin a 10 per cent. solution of albumen increased 9·0 cc. in volume, and an equally concentrated arabin solution 14·0 cc.; while, in the same time, when the membrane was animal bladder or parchment, the endosmose was hardly perceptible (0·5 cc.). This shows that the weak endosmotic action of colloids, when particular membranes are used, is not to be attributed to their weak attraction for water, but rather to the properties of the membrane. And in the above case it appears that the different behaviour of the membranes corresponds to their different absorptivity for water. Especially does this appear from the fact that a very different endosmose takes place with one and the same membrane, according as it is employed as pyroxilin, or after its reduction as cellulose (by a process described in a previous part of the paper). Thus a 7 per cent. arabin solution received, through a pyroxilin membrane, 5·3 cc. water; when the membrane was reduced, an equally concentrated solution showed no endosmose, and a 9 per cent. solution of the same substance only received about 0·45 cc. water.

For substances largely soluble in water, the attraction of their particles to water may have wide limits of variation, according

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* Abstract of part of a paper in "Poggendorff's Annalen," by J. Baranetzky.